Missouri Department of Natural Resources

Biological Assessment Report

Dardenne Creek
St. Charles County

September 2005 –March 2006

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Branch

Prepared by:

Missouri Department of Natural Resources
Field Services Division
Environmental Services Program
Water Quality Monitoring Section

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1.0 Introduction

At the request of the Water Protection Program (**WPP**), the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a follow-up biological assessment of a segment of Dardenne Creek. The follow-up request was based on a previous biological assessment (MDNR 2002b) in which the Dardenne Creek segment had demonstrated lower than expected metric and biological supportability scores. In the 2002 study, the macroinvertebrate community exhibited a notable decline in the station located just downstream of the Little Dardenne Creek confluence. A recommendation was made in the 2002 assessment that additional surveys be conducted that bracket the Little Dardenne Creek confluence to determine whether these lower scores were due to natural variability or whether some factor within the Little Dardenne Creek watershed was the cause.

Sampling at Dardenne Creek and Little Dardenne Creek was conducted on September 13, 2005 and March 13, 2006 to provide data to the WPP for use in evaluating the biological integrity of these two streams. Dave Michaelson, Ken Lister, and Randy Sarver of the Environmental Services Program, Field Services Division conducted the sampling.

The objectives of this study were to:

1) determine whether the pattern of macroinvertebrate community decline in the vicinity of the Little Dardenne Creek confluence observed in 2002 would be evident in a subsequent study;

2) establish a macroinvertebrate sample station on Little Dardenne Creek to observe whether differences in community composition and metric scores exist between the two streams;

3) collect water chemistry samples from Dardenne Creek upstream and downstream of Little Dardenne Creek as well as from Little Dardenne Creek itself.

2.0 Study Area

Dardenne Creek originates southwest of Foristell in eastern Warren County and flows through a rural landscape that becomes increasingly more developed in downstream reaches. Each of the stations in this study are classified as class "C" with beneficial use designations of "warm water aquatic life protection" and "livestock and wildlife watering" (MDNR 2005a). Little Dardenne Creek originates south of Wentzville in western St. Charles County and flows southeast through a mostly rural watershed to its confluence with Dardenne Creek. Little Dardenne Creek is also classified as class "C," with the same beneficial use designations listed above (MDNR 2005a). Maps showing the Dardenne Creek study sites and the study area relative to the Central Plains/Cuivre/Salt EDU are presented in Appendix A.

3.0 Station Descriptions

All of the following stations were located in St. Charles County, Missouri.
Dardenne Creek Station 3 (Survey 418, T. 46 N., R. 2 E.) was located downstream from the Hopewell Road Bridge. Geographic coordinates were measured at the riffle downstream from the Missouri Department of Conservation (**MDC**) fish sampling station marker (Lat. 38.739552, Long. –90.817097).

Dardenne Creek Station 4 (Survey 891, T. 46 N., R. 2 E.) was located upstream from the Hopewell Road Bridge and downstream of the Little Dardenne Creek confluence. Geographic coordinates were measured at the MDC fish sampling station marker (Lat. 38.744768, Long. –90.834204).

Dardenne Creek Station 4.1 (Survey 891, T. 46 N., R. 2 E.) was located upstream of the Little Dardenne Creek confluence. Geographic coordinates at the downstream terminus of the sample reach were Lat. 38.745048, Long. –90.838625.

Little Dardenne Creek Station 1 (Survey 891, T. 46 N., R. 2 E.) was located approximately 220 feet from the confluence with Dardenne Creek. Geographic coordinates at the downstream terminus of the sample reach were Lat. 38.746095, Long. –90.838618.

4.0 Methods

4.1 Macroinvertebrate Collection and Analyses

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003a). A total of three standard habitats—flowing water over coarse substrate (riffles and runs), depositional substrate in non-flowing water, and rootmat substrate at the stream edge—were sampled at all stations.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These metrics were scored and combined to form the Macroinvertebrate Stream Condition Index (**MSCI**). Macroinvertebrate Stream Condition Indices between 20-16 qualify as fully biologically supporting, between 14-10 are partially-supporting, and 8-4 are considered non-supporting of aquatic life. The multi-habitat macroinvertebrate data are presented in Appendix B as laboratory bench sheets.

Additionally, macroinvertebrate data were analyzed in the following specific ways. First, comparisons were made among reaches longitudinally. This comparison addresses influences that may result from water quality or other factors associated with the Little

Dardenne Creek watershed that are different from the Dardenne Creek watershed upstream of this point. Data are also summarized and presented in tabular format comparing means of the four standard metrics and other parameters at each of the stations on Dardenne and Little Dardenne creeks. These metrics as well as macroinvertebrate community attributes from the 2002 assessment study were compared with the present study. Finally, the data from Dardenne and Little Dardenne creeks were compared to biological criteria from reference streams within the same watershed size classification and within the same EDU.

4.2 Macroinvertebrate Laboratory Processing

Laboratory processing was conducted in a manner consistent with the methods outlined in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a). Each sample was processed under 10x magnification to remove a habitat-specific target number of individuals from debris. Individuals were identified to standard taxonomic levels (MDNR 2005d) and enumerated.

4.3 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations. Field measurements included temperature (MDNR 1993), dissolved oxygen (MDNR 2002), conductivity (MDNR 2000), turbidity (MDNR 2005c), and pH (MDNR 2001b). Additionally, water samples were collected by the WQMS and analyzed by ESP's Chemical Analysis Section for chloride, total phosphorus, ammonia-N, nitrate+nitrite-N, and total nitrogen (all parameters reported in mg/L). Procedures outlined in Field Sheet and Chain of Custody Record (MDNR 2001a) and Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2003c) were followed when collecting water quality samples. Stream velocity was measured at each station during the study using a Marsh-McBirney Flo-Mate™ Model 2000 flow meter. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-FSS-113, Flow Measurement in Open Channels (MDNR 2001c).

Physicochemical data were summarized and presented in tabular form for comparison among stations.

4.4 Additional Quality Assurance/Quality Control (QA/QC)

4.4.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with the Standard Operating Procedure MDNR-ESP-213, Quality Control Procedures for Checking Water Quality Field Instruments (MDNR 2005b).

4.4.2 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with the Standard Operating Procedure MDNR-WQMS-214, Quality Control Procedures for Data Processing (MDNR 2003b).

5.0 Data Results

5.1 Physicochemical Data

Discharge and non-nutrient water quality parameters for samples collected in fall 2005 are presented in Table 1, with nutrient data presented in Table 2. During the fall sample season, both Dardenne and Little Dardenne creeks had extremely low water levels, with no measurable surface flow. Water temperature, conductivity, and pH were similar among stations, whereas dissolved oxygen and turbidity were higher at Station 4.1. With the exception of Station 4.1, dissolved oxygen failed to meet the 5.0 mg/L minimum concentration listed in the Water Quality Standards for protection of aquatic life (warmwater and coolwater fisheries).

Table 1
Fall 2005 Discharge and *In situ* Dardenne Creek and Little Dardenne Creek Water Quality Measurements

	Parameter					
Station	Discharge (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
DC #3	0.0	22.0	2.20	403	7.80	4.72
DC #4	0.0	22.0	1.34	412	7.80	5.86
DC #4.1	0.0	23.0	5.27	439	8.10	20.6
LDC #1	0.0	23.0	1.62	428	7.60	6.42

Very little variation in nutrient parameters existed among stations in fall 2005 (Table 2). Ammonia as nitrogen and nitrate+nitrite-nitrogen were below detectable limits at each station. Total nitrogen was lowest at Dardenne Creek Station 3 and second lowest at the Little Dardenne Creek station. The remaining nutrient parameters were similar among stations, with no differences observed with respect to the stations' location relative to Little Dardenne Creek.

Table 2
Fall 2005 Dardenne Creek and Little Dardenne Creek Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
DC #3	*	*	0.10	0.07	15.6
DC #4	*	*	0.51	0.09	13.0
DC #4.1	*	*	0.65	0.09	13.1
LDC #1	*	*	0.34	0.04	12.2

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

Discharge and non-nutrient water quality parameters for samples collected in spring 2006 are presented in Table 3, with nutrient data presented in Table 4. During the spring sample season, measurable flow was observed at all stations, with discharge increasing while progressing downstream on Dardenne Creek. Temperature and pH were similar among sites, whereas some differences were observed in dissolved oxygen, conductivity, and turbidity. Dissolved oxygen was lowest at Little Dardenne Creek, with higher conductivity and turbidity observed at this site than the Dardenne Creek stations. Dissolved oxygen was slightly higher and turbidity was slightly lower at Dardenne Creek Station 4.1, upstream of Little Dardenne Creek.

Table 3
Spring 2006 Discharge and *In situ* Dardenne Creek and Little Dardenne Creek Water Quality Measurements

	Parameter					
Station	Discharge (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
DC #3	18.4	14.5	8.16	372	8.13	22.3
DC #4	15.0	14.5	9.63	393	8.30	15.7
DC #4.1	13.3	15.0	10.4	392	8.30	10.2
LDC #1	2.00	15.0	7.73	453	8.20	27.8

Ammonia as nitrogen and nitrate+nitrite-nitrogen were present in detectable limits (NH_3-N) or higher than laboratory Practical Quantitation Limits (NO_2+NO_3-N) only at Dardenne Creek Station 3 (Table 4). Total nitrogen concentrations were slightly higher at Dardenne Creek Station 3 and Little Dardenne Creek than the remaining two stations. Chloride concentrations were lowest at Dardenne Creek Station 4.1 and highest at the Little Dardenne Creek site; chloride levels were slightly higher at stations downstream from the Little Dardenne Creek confluence.

Table 4
Spring 2006 Dardenne Creek and Little Dardenne Creek Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
DC #3	0.10	0.06	0.72	0.08	24.4
DC #4	*	0.03**	0.55	0.05	24.8
DC #4.1	*	0.03**	0.54	0.06	22.6
LDC #1	*	0.02**	0.62	0.08	39.3

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

5.2 Biological Assessment

5.2.1 Dardenne Creek Longitudinal Assessment

Metrics and scores calculated for Dardenne and Little Dardenne creeks were compared to biological criteria based on reference sites from the Central Plains/Cuivre/Salt EDU. Criteria for fall and spring sample seasons—presented in Tables 5 and 6—were used to assess the overall health of the aquatic communities within the EDU.

Table 5
Biological Criteria for Warm Water Reference Streams in the Central Plains/Cuivre/Salt EDU, Fall Season

	Score = 5	Score = 3	Score = 1
TR	>73	73-37	<37
EPTT	>18	18-9	<9
BI	<6.34	6.34-8.17	>8.17
SDI	>2.96	2.96-1.48	<1.48

Table 6
Biological Criteria for Warm Water Reference Streams in the Central Plains/Cuivre/Salt EDU, Spring Season

	Score = 5	Score = 3	Score = 1
TR	>79	79-40	<40
EPTT	>18	18-9	<9
BI	<6.24	6.24-8.12	>8.12
SDI	>3.20	3.20-1.60	<1.60

Dardenne Creek Station 3, the most downstream station, achieved the highest MSCI score during both seasons. None of the stations, however, scored sufficiently high MSCI scores to achieve fully supporting status during either season (Tables 7 and 8). During the fall season, Taxa Richness ranged from 42 at the Little Dardenne Creek station to 66 at Dardenne Creek Station 3. In addition to having the highest Taxa Richness value, Dardenne Creek Station 3 also had the highest EPT Taxa, lowest Biotic Index, and highest Shannon Diversity Index values among the sites surveyed in this study. Little

Dardenne Creek had the lowest Taxa Richness value and also had the lowest EPT Taxa and highest Biotic Index values among the four stations. The Shannon Diversity Index at Little Dardenne Creek however was higher than all but Dardenne Creek Station 3.

Table 7
Dardenne Creek and Little Dardenne Creek Metric Values and Scores, Fall 2005 Season, Using Central Plains/Cuivre/Salt Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
DC #3 Value	66	10	7.39	3.10		
DC #3 Score	3	3	3	5	14	**Partial**
DC #4 Value	49	5	7.49	2.79		
DC #4 Score	3	1	3	3	10	**Partial**
DC #4.1 Value	49	7	7.52	2.71		
DC #4.1 Score	3	1	3	3	10	**Partial**
LDC #1 Value	42	4	8.05	2.91		
LDC #1 Score	3	1	3	3	10	**Partial**

Values for Taxa Richness, EPT Taxa, and Shannon Diversity Index were highest at Dardenne Creek Station 3 in spring 2006, with the Biotic Index value being lowest. Little Dardenne Creek had the lowest values for Taxa Richness and Shannon Diversity Index and had the highest Biotic Index value among the four sites in spring. The number of EPT Taxa was nearly identical among the Little Dardenne and Dardenne Creek stations #4 and #4.1.

Table 8
Dardenne Creek and Little Dardenne Creek Metric Values and Scores, Spring 2006 Season, Using Central Plains/Cuivre/Salt Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	SCI	Support
DC #3 Value	81	16	7.51	2.88		
DC #3 Score	5	3	3	3	14	**Partial**
DC #4 Value	63	12	7.68	2.66		
DC #4 Score	3	3	3	3	12	**Partial**
DC #4.1 Value	71	13	7.34	2.81		
DC #4.1 Score	3	3	3	3	12	**Partial**
LDC #1 Value	56	12	8.00	2.14		
LDC #1 Score	3	3	3	3	12	**Partial**

During the fall season, no differences in biological metrics were observed in the Dardenne Creek stations upstream versus downstream of the Little Dardenne Creek confluence. Taxa Richness values were identical at Stations 4 and 4.1, with the remaining metrics being similar. That Little Dardenne Creek appeared to have no notable effect on the macroinvertebrate community is not surprising given that this tributary was

contributing no surface flow to Dardenne Creek. During the spring, however, there were differences in the Dardenne Creek biological metrics at Station 4 compared to Station 4.1. Compared to Station 4.1, upstream of Little Dardenne Creek, Station 4 had eight fewer total taxa, a lower Shannon Diversity Index value, and a higher Biotic Index value. None of these differences were sufficient to affect the individual metrics' scores or the supportability ranking, however.

5.2.2 Macroinvertebrate Percent and Community Composition

Macroinvertebrate Taxa Richness, EPT Taxa, and percent EPT are presented in Table 9 and Table 10. These tables also provide percent composition data for the five dominant macroinvertebrate families at each station sampled during this study. The percent relative abundance data were calculated from the sum of three macroinvertebrate habitats—coarse substrate (spring season only), nonflow, and rootmat—sampled at each station.

Fall 2005 macroinvertebrate samples from Dardenne and Little Dardenne creeks averaged 52 total taxa (range 42-66) and 7 EPT taxa (range 4-10). Midge larvae (Chironomidae) were the dominant taxa and squaregill mayflies (Caenidae) were second in abundance at each Dardenne Creek station. Compared to Dardenne Creek, chironomids made up a higher percentage of the Little Dardenne Creek sample, with marsh beetles (Scirtidae) being second in abundance. Mayflies made up a much lower percentage of the Little Dardenne Creek sample (5.1 percent), compared to even the lowest among Dardenne Creek samples (Station 4.1, with 21.1 percent). Although the highest percentage of mayflies occurred at Station 4, there was not a large difference among the Dardenne Creek sites. A single species, *Caenis latipennis*, was the dominant mayfly taxon at each station. Caddisflies (Trichoptera) were relatively rare among samples. Whereas Station 3 had the greatest caddisfly abundance, accounting for 3.3 percent of all individuals, caddisflies made up only 0.3 percent (two individuals) of the Station 4.1 sample. Station 4 and the Little Dardenne Creek site had no caddisflies. At Station 3, the only site that had an appreciable number of caddisfly taxa, no single genus was dominant among the five present. No stoneflies (Plecoptera) were present among fall samples.

Table 9
Fall 2005 Dardenne and Little Dardenne Creek Macroinvertebrate Composition

↓Variable Station→	DC #3	DC #4	DC #4.1	LDC #1
Taxa Richness	66	49	49	42
Number EPT Taxa	10	5	7	4
% Ephemeroptera	24.2	29.8	21.1	5.1
% Plecoptera	0.0	0.0	0.0	0.0
% Trichoptera	3.3	0.0	0.3	0.0
SCI Score	14	10	10	10
% Dominant Families				
Chironomidae	32.2	46.1	26.5	54.9
Caenidae	22.0	28.7	19.5	--
Hyalellidae	9.7	2.9	10.4	--
Arachnoidea	6.6	--	--	--
Coenagrionidae	5.9	--	--	--
Elmidae	--	6.5	17.4	--
Ancylidae	--	3.2	--	--
Tubificidae	--	--	9.7	7.9
Scirtidae	--	--	--	10.7
Ceratopogonidae	--	--	--	8.4
Planorbidae	--	--	--	4.3

Spring 2006 macroinvertebrate samples averaged 68 total taxa (range 56-81) and 13 EPT taxa (range 12-16). Chironomidae was the dominant taxonomic family at all stations, with caenid mayflies being second in abundance at all Dardenne Creek sites. Although perlodid stoneflies (Perlodidae) made up only 3.6 percent of the Little Dardenne Creek sample, they were second in abundance. Chironomids made up a large majority of individuals at each site, such that the top two abundant families (Chironomidae and Caenidae) accounted for over 80 percent of each sample. Although the actual number of mayflies present in spring Dardenne Creek samples was comparable to or higher than the fall, mayflies made up a much lower percentage of the total in spring due to the increased abundance of chironomids. The total number and diversity of mayflies decreased from fall at the Little Dardenne Creek site, despite having an additional habitat (coarse substrate) contributing to the overall sample. The mayfly species *Caenis latipennis* again was the dominant mayfly taxon at each site. Caddisfly abundance was slightly lower in spring and, as was the case with fall samples, Station 3 exhibited the highest caddisfy diversity. Although the number of caddisfly individuals present at Station 4.1 was comparable to Station 3, there were only two taxa present compared to five taxa at Station 3. The remaining sites, Station 4 and Little Dardenne Creek Station 1, each had a total of three caddisfly taxa representing four or fewer individuals. Unlike the fall, stoneflies were present in spring samples at each station. Among all four sites, stoneflies were most abundant and diverse in Little Dardenne Creek, making up 8 percent of the overall sample. Within the Dardenne Creek sites, Station 3 had the most stonefly diversity at six taxa, with four of those taxa being represented by a single individual.

Station 4 and Station 4.1 each had four stonefly taxa. Two stonefly genera, *Isoperla* and *Perlesta,* were dominant at each station.

Table 10
Spring 2006 Dardenne and Little Dardenne Creek Macroinvertebrate Composition

↓Variable Station→	DC #3	DC #4	DC #4.1	LDC #1
Taxa Richness	81	63	71	56
Number EPT Taxa	16	12	13	12
% Ephemeroptera	17.6	9.5	11.3	0.8
% Plecoptera	1.1	2.1	5.2	8.0
% Trichoptera	1.1	0.3	1.1	0.2
SCI Score	14	12	12	12
% Dominant Families				
Chironomidae	67.0	77.2	72.1	76.8
Caenidae	16.6	8.6	8.5	--
Ceratopogonidae	2.8	--	--	--
Arachnoidea	1.7	--	--	--
Tubificidae	1.2	2.4	--	--
Elmidae	--	1.5	--	--
Hyalellidae	--	1.5	--	--
Empididae	--	1.2	2.3	1.5
Perlodidae	--	--	4.0	3.6
Baetidae	--	--	1.8	--
Enchytraeidae	--	--	--	2.9
Perlidae	--	--	--	2.9
Scirtidae	--	--	--	2.2

5.2.3 Comparisons of Dardenne Creek and Little Dardenne Creek versus Central Plains/Cuivre/Salt EDU Biological Criteria Reference Sites

Macroinvertebrate data for three biocriteria reference streams sampled in fall between 1999 and 2005 are presented in Table 11 and the data for two reference streams sampled in spring between 1999 and 2006 are presented in Table 12. Taxa Richness averaged 77 (range 65-83) in fall samples and 82 (range 70-93) in spring samples. Total EPT Taxa averaged 18 (range 14-22) in fall and 20 (range 17-23) in spring samples. With the exception of Station 3, fall Taxa Richness values for each of the four stations was lower than any of the reference sites. The number of EPT Taxa among the study sites was considerably lower than any of the references, with the highest EPT Taxa value at Station 3 having four taxa fewer than the lowest reference value. Mayflies made up a wide variety of the samples among references, ranging from 6.2 percent to 40.2 percent. Only Little Dardenne Creek failed to fall within this mayfly percentage range. Stoneflies were present at only one reference site in fall, and made up less than one percent of the sample. Similarly, no stoneflies were present among the Dardenne Creek and Little Dardenne Creek fall samples. Whereas caddisflies made up between 9.6 and 24.2 percent of

reference samples, they represented no more than 3.3 percent of study samples and two of the four sites had no caddisflies. Chironomids were the dominant group at six of the 10 fall reference sites, but accounted for over half of individuals in only one sample. Chironomids and riffle beetles (Elmidae) were present among the dominant taxa at each of the references, with leptohyphid mayflies and common netspinner caddisflies (Hydropsychidae) also included at the majority of reference streams.

Although the spring Dardenne Creek macroinvertebrate community was more similar to the suite of references compared to fall, notable differences were present. Taxa Richness at Station 4 and the Little Dardenne Creek station were lower than any of the reference samples. In addition, only Station 3 had EPT Taxa values comparable to the references, with the remaining sites being much lower. Mayfly percentage among the study sites tended to be lower compared to the references, particularly at Station 4 and Little Dardenne Creek. The percentage of mayflies at each of the study sites was lower than all but one reference sample. Stoneflies made up between 1.0 and 7.0 percent of reference samples, which encompasses the range present among the Dardenne Creek sites. The Little Dardenne Creek sample had a slightly higher percentage of stoneflies than the upper reference percentage. The highest percentage of caddisflies in samples occurred at Dardenne Creek Station 3 and Station 4.1, which was slightly less than the lowest reference percentage. Chironomids were the dominant group among each reference station sampled, but made up half or more of individuals in only two of six samples. Riffle beetles and caenid mayflies were among the top five dominant taxa among reference streams, with the exception that elmids were present in lower numbers in a 1999 South Fabius River sample.

Table 11
Central Plains/Cuivre/Salt EDU Biological Criteria Reference Stream Macroinvertebrate Composition, Fall Season

	South River			North River			South Fabius River			
Sample Year	1999	2000	2002	2001	2001	2001	1999	2000	2005	2005
↓Variable Station→	1	1	1	1	2a	2b	1	1	1a	1b
Taxa Richness	79	81	65	81	82	83	80	68	73	74
Number EPT Taxa	18	18	14	17	21	22	18	18	18	18
% Ephemeroptera	26.5	31.6	40.2	8.0	17.3	21.7	14.5	6.2	29.8	35.8
% Plecoptera	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Trichoptera	24.2	11.8	17.4	19.7	12.8	10.9	18.4	17.0	9.6	10.8
SCI Score	18	18	14	16	20	20	14	14	16	16
% Dominant Families										
Chironomidae	27.1	21.4	13.0	43.8	33.0	32.5	42.4	57.1	12.3	14.1
Philopotamidae	10.1		10.4	--	--	--	--	--	--	--
Leptohyphidae	10.1	26.1	36.8	3.2	7.0	11.3	8.3	--	18.6	22.4
Caenidae	7.8		--	--	--	--	4.1	--	--	--
Elmidae	7.5	14.1	5.6	12.4	12.1	14.8	11.9	6.8	15.4	19.3
Hyalellidae	--	6.7	--	--	10.8	5.1	--	--	--	--
Hydropsychidae	--	4.6	--	15.8	6.9	5.6	17.5	14.8	--	7.6
Tubificidae	--	--	6.6	--	--			--	--	--
Coenagrionidae	--	--	--	4.2	--			3.4	--	--
Baetidae	--	--	--	--	--	--	--	2.2	--	--
Corixidae	--	--	--	--	--	--	--	--	12.4	6.9
Leptoceridae									5.2	--

Table 12
Central Plains/Cuivre/Salt EDU Biological Criteria Reference Stream Macroinvertebrate Composition, Spring Season

		South River			South Fabius River		
Sample Year		1999	2000	2000	1999	2000	2006
↓Variable	Station→	1	1a	1b	1	1	1
Taxa Richness		82	84	82	78	70	93
Number EPT Taxa		17	20	21	22	17	23
% Ephemeroptera		23.3	20.7	21.6	48.7	6.5	25.0
% Plecoptera		2.7	1.0	1.4	2.4	7.0	2.1
% Trichoptera		5.3	5.1	4.0	1.2	2.0	2.3
SCI Score		18	18	18	16	14	20
% Dominant Families							
Chironomidae		34.2	46.1	51.0	22.4	64.4	31.3
Elmidae		18.6	9.8	6.4	--	8.5	11.5
Caenidae		12.1	10.4	14.1	15.8	4.3	8.6
Leptohyphidae		7.1	4.4	5.5	--	--	--
Gammaridae		3.8	--	--	--	--	--
Heptageniidae		--	5.0	--	9.0	--	--
Simuliidae		--	--	2.9	--	4.9	--
Perlidae		--	--	--	--	6.9	--
Baetidae		--	--	--	17.7	--	8.7
Tubificidae		--	--	--	7.7	--	--
Corixidae		--	--	--	--	--	10.6

5.2.4 Comparison of Present Macroinvertebrate Community with the 2002 Biological Assessment

Dardenne Creek Station 3 and Station 4 were sampled during a 2002 Biological Assessment (MDNR 2002) as well as for the current study. Macroinvertebrate Taxa Richness, EPT Taxa, and percent EPT for these two studies are presented for comparison in Table 13. This table also provides percent composition data for the five dominant macroinvertebrate families at each station sampled during the two studies.

Taxa Richness and EPT Taxa were higher in spring 2006 at both Dardenne Creek stations than 2002. Mayflies made up a considerably higher percentage of the spring samples at each site in 2006 and, although percentages also were higher for stoneflies and caddisflies, the differences were not as great. Chironomidae was the dominant taxonomic family group in spring samples during both survey periods, but in 2002 chironomids accounted for nearly the entire sample at Stations 3 and 4. At Station 3, 94 percent of the sample was chironomid taxa, whereas the next nearest dominant taxa accounted for 0.5 percent. At Station 4, chironomids were responsible for 91 percent of the sample with the next three dominant taxa making up between 1 and 2 percent. In 2006, chironomids were dominant at Stations 3 and 4, but accounted for a lower percentage of the total

Table 13
Comparison of Dardenne Creek Macroinvertebrate Community: 2002 Biological Assessment with the Present Study

	Dardenne Creek Station 3				Dardenne Creek Station 4				
Sample Year	s 2002	s 2006	f 2002	f 2005	s 2002	s 2006	f 2002a	f 2002b	f 2005
Taxa Richness	56	81	90	66	57	63	49	53	49
Number EPT Taxa	12	16	14	10	11	12	5	6	5
% Ephemeroptera	0.7	17.6	18.1	24.2	1.0	9.5	1.8	4.5	29.8
% Plecoptera	0.8	1.1	0.0	0.0	1.4	2.1	0.0	0.0	0.0
% Trichoptera	0.1	1.1	3.2	3.3	<0.1	0.3	2.1	2.5	0.0
MSCI Score	8	14	16	14	8	12	10	12	10
% Dominant Families									
Chironomidae	94.0	67.0	42.9	32.2	91	77.2	50.6	46.2	46.1
Enchytraeidae	0.5	--	--	--	1.5	--	--	--	--
Scirtidae	0.5	--	--	--	--	--	4.5	5.2	--
Baetidae	0.4	--	--	--	--	--	--	--	--
Perlodidae	0.4	--	--	--	0.7	--	--	--	--
Caenidae	--	16.6	16.2	22.0	--	8.6	--	--	28.7
Ceratopogonidae	--	2.8	13.3	5.9	--	--	--	5.2	--
Arachnoidea	--	1.7	--	--	--	--	--	--	--
Tubificidae	--	1.2	--	--	1.1	2.4	10.1	--	--
Tipulidae	--	--	--	--	1.2	--	--	--	--
Hyalellidae	--	--	4.1	9.7	--	1.5	13.9	12.0	2.9
Elmidae	--	--	--	6.6	--	1.5	--	--	6.5
Empididae	--	--	--	--	--	1.2	--	--	--
Hydrophilidae	--	--	3.4	--	--	--	--	--	--
Coenagrionidae	--	--	--	--	--	--	4.7	--	--
Planorbidae	--	--	--	--	--	--	--	4.9	--
Ancylidae	--	--	--	--	--	--	--	--	3.2

sample compared to 2002. With MSCI scores of 8, both Dardenne Creek Stations 3 and 4 were non-supporting in spring 2002. An increase in Biotic Index and Shannon Diversity Index scores enabled each of these stations to achieve a partially-supporting score in 2006.

Taxa Richness and EPT Taxa were lower at Station 3 in fall 2005 compared to 2002, but relatively unchanged at Station 4 (the four biological metrics used to calculated the fall 2002 MSCI scores were virtually identical to the 2005 metric values). Mayflies made up a slightly higher percentage of the Station 3 sample in 2005. Mayflies were relatively rare, however, in both 2002 duplicate samples collected at Station 4 and mayflies accounted for a much greater percentage of the 2005 sample. Stoneflies were absent from Stations 3 and 4 during both fall sample seasons. Caddisflies made up nearly equal percentages of 2002 and 2005 fall samples at Station 3, but were absent from the 2005 Station 4 sample. Chironomids were the dominant taxa group at both stations in 2002 and 2005 fall samples and were present in comparable percentages among sites and years. At Station 3, caenid mayflies were second in abundance during both years that this site was sampled. At Station 4, however, caenids were not represented among the top five dominant taxa in 2002 but were second in abundance in 2005. Fall MSCI scores for individual stations were mostly unchanged between sample years; however when compared, Station 4 MSCI scores were consistently lower than those of Station 3. Despite this difference in scores between Stations 3 and 4, both sites achieved a partially-supporting status during fall in both sample years.

To assess the degree to which the 2005/2006 macroinvertebrate community differed from the 2002 community, the quantitative similarity index (**QSI**) was calculated for Dardenne Creek Stations 3 and 4 for both seasons. Spring QSI values are presented in Table 14 with fall values in Table 15. Overall, QSI values were relatively low for both seasons, the highest value being 58.2, which occurred when comparing Station 3 fall data. Quantitative Similarity Index values were consistently higher for fall samples, with the lowest fall QSI value being greater than the highest spring value. For fall 2002 versus 2005 data, the highest QSI values occurred when comparing each station to itself. This seemingly obvious observation was not strictly the case, however, given that the spring 2002 Station 3 sample was more similar to the 2006 Station 4 sample.

Table 14
Dardenne Creek Quantitative Similarity Index Values, Spring Season

	Spring 2006		
Spring 2002	Station #	3	4
	3	36.4	41.8
	4	37.9	41.5

Table 15
Dardenne Creek Quantitative Similarity Index Values, Fall Season

	Fall 2005		
Fall 2002	Station #	3	4
	3	58.2	44.2
	4	47.0	50.3

6.0 Discussion

There was no surface flow at the time these four stations were sampled in fall. Both Dardenne Creek and Little Dardenne Creek consisted of isolated and apparently stagnant pools, which could have allowed water quality parameters to fluctuate independently among stations depending on instream and riparian conditions within their immediate vicinity. Although a few non-nutrient water quality parameter differences did exist among stations in fall 2005, most were similar. Turbidity and dissolved oxygen both were higher at Dardenne Creek Station 4.1 than the remaining three stations. Compared to Dardenne Creek Station 4 and the Little Dardenne Creek station, Station 4.1 had a much narrower riparian corridor, with almost no trees along the right descending bank. It is possible that this reduced shading and increased sunlight exposure may have resulted in more algae, which would have led to higher afternoon dissolved oxygen levels and perhaps turbidity readings at Station 4.1. Dardenne Creek Station 3 was similarly exposed to sunlight and, although dissolved oxygen was below the 5 mg/L threshold limit at this site, it was slightly higher than either Station 4 or the Little Dardenne Creek site, both of which were more heavily shaded. Few differences in nutrient levels were observed among stations and, although total nitrogen showed the largest fluctuations, the changes were slight. The remaining nutrient values were either below detectable limits or were consistent among stations, despite the fact that each station was functionally a separate pool.

Each site, including Little Dardenne Creek, had measurable flow during the spring sample season. Non-nutrient as well as nutrient-based water quality parameters were mostly similar among Dardenne Creek stations. Although Little Dardenne Creek exhibited lower dissolved oxygen levels with higher conductivity, turbidity, and chloride concentrations than the Dardenne Creek stations, Stations 4 and 4.1 were more closely aligned with one another than the tributary station or the downstream station. That there was little difference among water quality parameters between Stations 4 and 4.1 is an important distinction due to the two stations being separated by Little Dardenne Creek. The 2002 biological assessment report (MDNR 2002) questioned whether the Dardenne Creek macroinvertebrate community at Station 4 was being negatively affected by some factor associated with the Little Dardenne Creek watershed because it was the only site that did not follow the trend of increasing MSCI scores from upstream to downstream. Although the water quality data for these studies were far from all-inclusive (for example, we did not analyze for such groups as pesticides or volatile organic compounds), nothing

in the Little Dardenne Creek watershed suggested that these additional compounds should be present. Visual observations of the subwatershed that were conducted when traveling to the study sites and observations from satellite photography (Google™ Maps) indicated that the land use and cover surrounding Little Dardenne Creek was similar to that of the remaining study reach.

Lack of measurable flow during the fall 2005 sample season resulted in the absence of coarse substrate habitat at each station. This habitat is usually the most productive and, due to our sampling and laboratory processing protocols, contributes roughly half of the individual macroinvertebrates in riffle-pool samples. With this habitat missing, low biological metric scores usually can be assured and this was certainly the case in this study. Although similar drought conditions were encountered during the 2002 biological assessment, we were able to collect a coarse substrate habitat sample at Station 3; riffles were without surface flow at the remaining three upstream stations, however. As a result, there was a sharp decrease in fall Taxa Richness and MSCI scores, with mostly lower EPT Taxa scores at the upstream sites beginning with Station 4. Biological metric scores and MSCI scores were similarly distributed along the stream gradient in this study. Station 3 had greater Taxa Richness and EPT Taxa values than the upstream or tributary stations, despite the fact that its sample also was missing the coarse substrate component. As was the case with the water quality data, biological metrics for Dardenne Creek Station 4 were more similar to those of Station 4.1 than the remaining stations; however the overall differences among stations were slight, with each site achieving a rank of partially biologically supporting. No inference could be made on whether Little Dardenne Creek contributes to a decline in the Dardenne Creek macroinvertebrate community based on the fall data. Because there was no surface flow and each station was essentially isolated from one another, it is doubtful that any tributary had contributed water to Dardenne Creek in the weeks prior to our fall sampling. It is likely that the low biological metric and MSCI scores throughout the study reach, including Little Dardenne Creek, were attributable to a lack of adequate water to maintain sufficient dissolved oxygen and habitat in riffle habitat.

Measurable flow was present at each of the study sites during the spring 2006 sample season. As a result, we were able to collect macroinvertebrate samples from each of the three target habitats, including coarse substrate. Adding the coarse substrate component to the spring sample contributed to higher Taxa Richness and EPT Taxa values compared to the fall samples. The increase in Taxa Richness observed in spring ranged between 14 (Station 4, Little Dardenne Creek) and 22 (Station 4.1), whereas EPT Taxa increased between 6 (Station 3, Station 4.1) and 8 (Little Dardenne Creek). By comparison, the difference in Biological Criteria between spring and fall Taxa Richness for the Central Plains/Cuivre/Salt EDU is an increase of 6 taxa in spring (Table 5 and Table 6). There is no difference between seasons in the Biological Criteria for EPT Taxa. Despite improvements in the values of these metrics, there was no change in the MSCI score at Station 3 and although each of the remaining stations' MSCI scores increased slightly, the difference was insufficient to change from partially-supporting status. As was the case with fall samples, Taxa Richness was highest at Station 3, but the largest increase—

from fall to spring—occurred at Station 4.1, where Taxa Richness increased by 22 taxa. By comparison, Taxa Richness at each of the remaining stations was between 14 and 15 taxa higher than the previous fall. There were 8 fewer taxa at Station 4 than Station 4.1, with aquatic worms and aquatic beetles accounting for the majority of the difference. Although this decline occurred downstream of the Little Dardenne Creek confluence, the fact that relatively tolerant organisms accounted for the majority of "missing" taxa while the numbers of EPT Taxa remained nearly unchanged casts doubt on the premise that Little Dardenne Creek adversely affects the Dardenne Creek macroinvertebrate community.

Several of the biological metrics for Dardenne and Little Dardenne creeks were lower when compared to the reference stations within the Central Plains/Cuivre/Salt EDU. Although Station 3 had the highest Taxa Richness and EPT Taxa values during the fall sample season, these metrics were most similar to the lowest value among 10 reference samples. Spring samples were similarly low compared to the reference community, but with two of the sample sites—Station 3 and Station 4—having Taxa Richness values approximating those of the reference samples. The highest EPT Taxa values among the study sites were a fraction of the spring references. As was the case in discussing the macroinvertebrate community composition above, availability of flowing water is the likely factor in explaining the differences observed between the study stations and the references. Each of the references had been sampled on multiple occasions, encompassing a range of flow conditions. For example, the lowest fall Taxa Richness and EPT Taxa values occurred during 2002 at South River, which was under drought conditions during the time leading up to the sample season. This reinforces the premise that low flows are at least partially responsible for the low fall scores observed at Dardenne Creek. In the case of the Dardenne Creek spring 2006 samples, although flow was sufficient to provide adequate habitat during the sample season, dry conditions that had affected the outcome of samples from the previous fall continued through the winter and into early spring. It was not until March 2006 that an increase in flow was measured at USGS gaging station 055148440, which is several miles downstream of the study reach in O'Fallon. Even with the increased flow experienced in March, the average discharge was 26.7 cfs, less than half the mean monthly discharge of 69 cfs for the seven-year period of record.

Dardenne Creek Stations 3 and 4 were sampled during both the 2002 and the present biological assessment study. When comparing spring samples, Taxa Richness and EPT Taxa were higher at both stations in 2006. During the fall, however, these metrics were much lower in the 2005 Station 3 sample, but mostly unchanged at Station 4. In addition, both Stations 3 and 4 achieved non-supporting MSCI scores in spring and partially-supporting scores in fall 2002. Compared to spring 2002, the 2006 macroinvertebrate community exhibited an overall increase in diversity. Whereas chironomids accounted for over 90 percent of the 2002 sample at both stations, they made up a much lower percentage of the spring 2006 sample, with more taxa contributing higher percentages to the overall community. The Shannon Diversity Index was nearly three times higher in spring 2006 compared to 2002. These improvements occurred despite Dardenne Creek

having considerably lower discharge in the months leading up to the spring 2006 sample season. It is possible that the low scores and altered macroinvertebrate community observed in spring 2002 may have been due to some acute event occurring prior to our sample season. By fall 2002, MSCI scores, Taxa Richness, EPT Taxa, percent mayflies, and percent caddisflies all had improved at Station 3 compared to the previous spring. Unlike Station 3, however, increases in these fall biological indices either did not occur or were less pronounced at Station 4, likely due to lack of flow preventing the collection of a coarse substrate sample at this site. Taxa Richness and EPT Taxa values in fall 2002 were actually lower than spring, whereas percent mayflies and percent caddisflies were slightly higher. The Station 4 fall 2002 MSCI score increased from 8 to 10, which allowed this site to achieve partially-supporting status (this is compared to Station 3, where the MSCI score changed from 8 to 16). In terms of flow, fall conditions were very similar at Station 4 in 2002 and 2005. It is somewhat encouraging to see that the macroinvertebrate community metrics were virtually the same for both biological assessments despite even lower discharge rates occurring over a longer period of time prior to the fall 2005 sample season.

7.0 Summary

1. There was no measurable flow during the fall 2005 sample season and, based on USGS gaging station data, flow continued to be well below the mean monthly discharge through the winter and including the spring 2006 sample season.

2. With the exception of Dardenne Creek Station 4.1, each of the study stations had dissolved oxygen concentrations below the 5 mg/L minimum concentration listed in the Missouri Water Quality Standards in fall 2005.

3. Little Dardenne Creek appeared to have little effect on Dardenne Creek, based on the water quality parameters collected for this study.

4. Due to low flow conditions, coarse substrate (riffle) habitat was unavailable for sampling during the fall 2005 season.

5. Each station during this study achieved only partially biologically supporting status during both seasons.

6. Although there were differences in some biological metrics when comparing Dardenne Creek stations upstream versus downstream of the Little Dardenne Creek confluence during spring 2006, none of these differences was sufficient to affect the score of any of the metrics or the overall MSCI score. In addition, the metric that showed the largest difference between the two sites—Taxa Richness—was mostly accounted for by relatively tolerant aquatic worms and beetles.

7. Midges (Chironomidae) were the most abundant taxa group and squaregill mayflies (Caenidae) were second in abundance at each Dardenne Creek station during both sample

seasons. Chironomidae also was the dominant family during both seasons at Little Dardenne Creek, but perlodid stoneflies were second in abundance in the spring sample and marsh beetles (Scirtidae) were second in abundance in the fall sample.

8. Compared to reference streams within the Central Plains/Cuivre/Salt EDU, the biological metrics associated with sites in this study were, at best, comparable to the lowest reference metrics and macroinvertebrate community composition attributes.

9. Despite lower flows in spring 2006, Taxa Richness and EPT Taxa values were higher than values observed in 2002 at both Dardenne Creek Station 3 and Station 4. Fall 2005 Taxa Richness and EPT Taxa were lower at Station 3 than 2002. At Station 4 the four biological metrics that combine to form the MSCI score were virtually identical when comparing the fall data from this study to the 2002 biological assessment.

8.0 Recommendation

Each of the biological assessment studies conducted on Dardenne Creek have coincided with extended periods of dry weather and low flow. As a result, it is unlikely that either assessment is an accurate reflection of what the Dardenne Creek macroinvertebrate community is during a season of average precipitation. We recommend that an assessment be conducted within this study reach after the watershed has had at least two years of near-average precipitation to determine how the biological metric values and MSCI scores respond to adequate flows.

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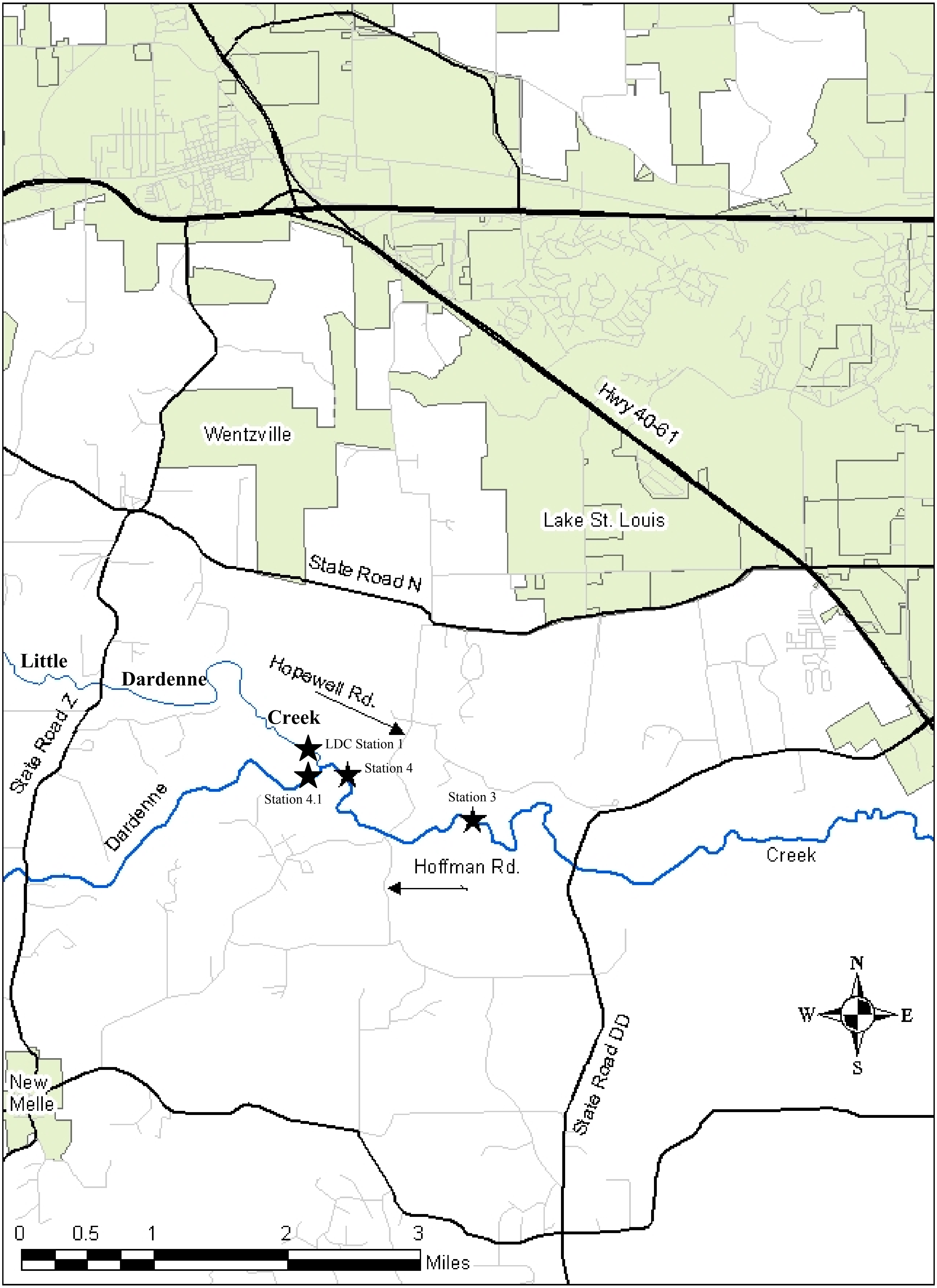
Appendix A

Maps

Dardenne Creek and Little Dardenne Creek Sample Stations
Central Plains/Cuivre/Salt EDU

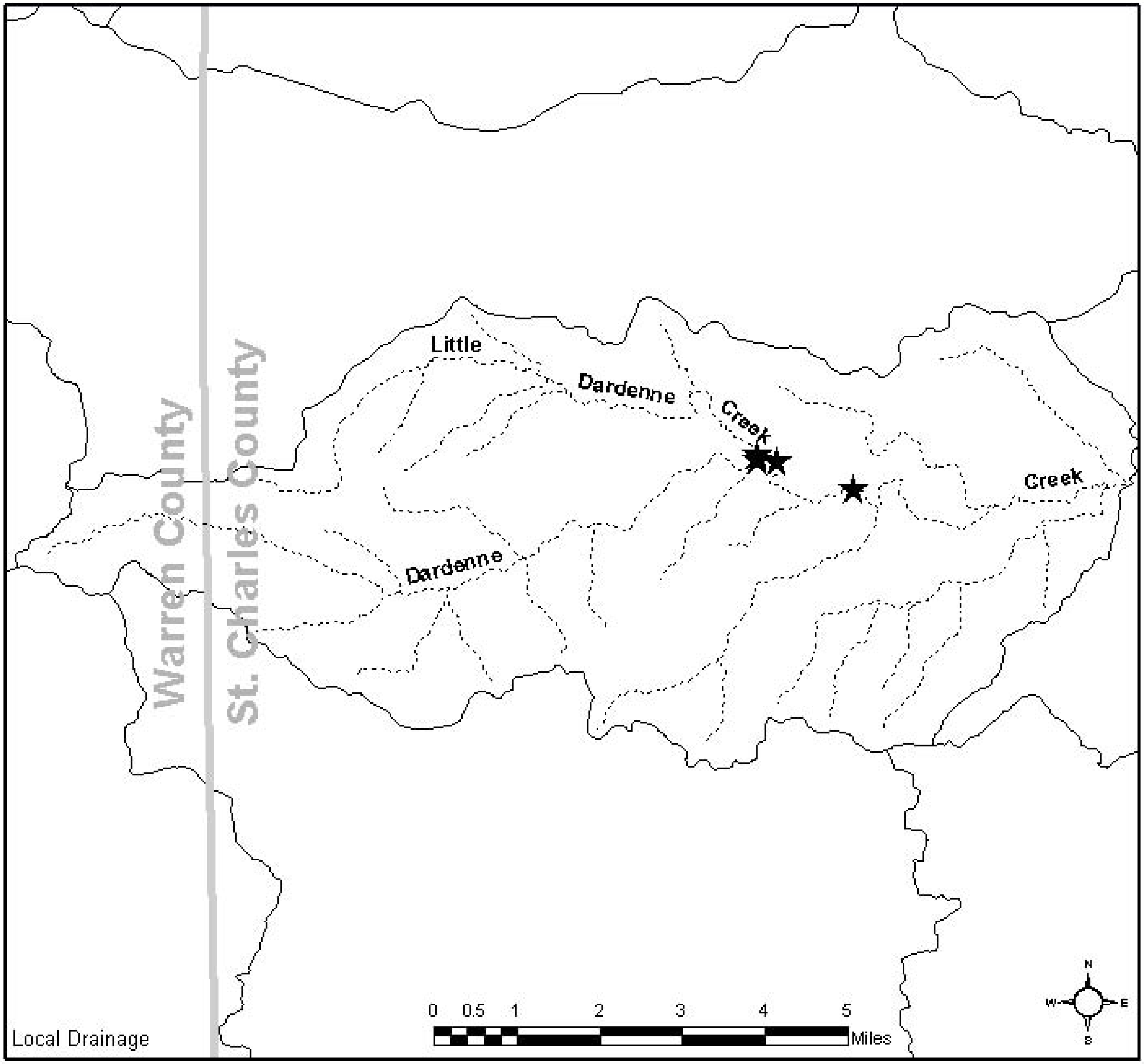
&

Dardenne Creek Study Area
Central Plains/Cuivre/Salt EDU



Wentzville
Hwy 40-61
Lake St. Louis
State Road N
Little
Dardenne
Creek
Hopewell Rd.
LDC Station 1
Station 4
Station 4.1
Station 3
State Road Z
Dardenne
Creek
Hoffman Rd.
N
W
E
S
New
Melle
State Road DD
0
0.5
1
2
3
Miles

Dardenne Creek Study Site



Sampling Location

County Boundary

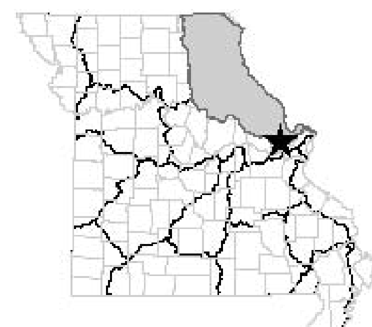
Local Drainage

Stream/River

Local Drainage and Biologic Sampling Site Location

Ecolocial Drainage Unit (EDU) - An EDU is an area that contains a unique combination of habitats and organisms. Missouri is divided into 19 EDUs as shown in the inset map below. This site is located in the highlighted EDU.

Local Drainage - The local drainage area, also known as a 14 Digit Hydrologic Unit, is shown in the main map at left. This area is a portion of the local watershed. Missouri is split into over 1500 such units.



Ecological Drainage Unit

Appendix B

Dardenne Creek and Little Dardenne Creek Macroinvertebrate Taxa Lists

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503071], Station #3, Sample Date: 9/13/2005 10:00:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
"HYDRACARINA"		
Acarina	1	41
AMPHIPODA		
Hyalella azteca	5	57
ARHYNCHOBDELLIDA		
Erpobdellidae		-99
COLEOPTERA		
Berosus	9	4
Dubiraphia		7
Helichus lithophilus	1	2
Scirtidae		4
DECAPODA		
Orconectes luteus	-99	
DIPTERA		
Ablabesmyia	33	3
Anopheles		1
Ceratopogoninae	6	2
Chaoborus	1	
Chironomus	30	
Cladopelma	3	
Cladotanytarsus	1	
Clinotanypus	1	
Cricotopus/Orthocladius		1
Cryptochironomus	1	
Dicrotendipes	6	
Forcipomyiinae		3
Glyptotendipes	1	8
Hexatoma	-99	
Labrundinia	3	6
Microtendipes		1
Nanocladius		2
Parachironomus		4
Paratanytarsus	1	8
Paratendipes	1	
Polypedilum halterale grp	1	
Polypedilum illinoense grp		2
Procladius	8	
Pseudochironomus	10	1
Rheotanytarsus	1	
Stempellinella		1

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503071], Station #3, Sample Date: 9/13/2005 10:00:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
Tanypus	1	
Tanytarsus	42	22
Tribelos		1
undescribed Empididae	4	
Zavreliella	1	
EPHEMEROPTERA		
Caenis latipennis	99	41
Callibaetis	1	1
Hexagenia limbata	1	
Procloeon	3	
Stenonema femoratum	7	1
HEMIPTERA		
Corixidae	1	
Microvelia		1
Rheumatobates	1	
Trepobates		1
LIMNOPHILA		
Ferrissia		2
Fossaria		1
Menetus		12
Physella	3	19
NEUROPTERA		
Climacia		1
ODONATA		
Argia		10
Enallagma		28
Erythemis		2
Libellula	1	1
Tetragoneuria		1
TRICHOPTERA		
Hydroptila	3	1
Oecetis	1	1
Orthotrichia		4
Oxyethira	3	4
Triaenodes		4
TUBIFICIDA		
Branchiura sowerbyi	8	
Tubificidae	11	2
VENEROIDEA		
Corbicula	1	-99

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503072], Station #4, Sample Date: 9/13/2005 11:15:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	**NF**	**RM**
"HYDRACARINA"		
Acarina	2	7
AMPHIPODA		
Hyalella azteca		17
BRANCHIOBDELLIDA		
Branchiobdellida		2
COLEOPTERA		
Dubiraphia	18	18
Helichus lithophilus		3
Scirtidae	1	14
Stenelmis	2	
DECAPODA		
Orconectes virilis		2
DIPTERA		
Ablabesmyia	2	1
Anopheles		1
Ceratopogoninae	4	
Chaoborus	1	
Chironomus	56	9
Cladotanytarsus	24	
Cryptotendipes	1	
Dicrotendipes	1	13
Glyptotendipes		36
Hexatoma	2	
Kiefferulus	3	1
Labrundinia		3
Microtendipes	2	1
Parachironomus	1	4
Paracladopelma	1	
Paratanytarsus	3	25
Paratendipes	1	
Polypedilum halterale grp	23	
Polypedilum illinoense grp	1	
Procladius	9	
Pseudochironomus	1	
Stictochironomus	8	
Tanypus	1	
Tanytarsus	19	16
EPHEMEROPTERA		
Baetidae		1

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503072], Station #4, Sample Date: 9/13/2005 11:15:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
Caenis latipennis	66	100
Hexagenia limbata	-99	
Leptophlebiidae		2
Stenonema femoratum	1	2
HEMIPTERA		
Veliidae		1
ISOPODA		
Caecidotea		3
LIMNOPHILA		
Ferrissia	11	8
Fossaria		1
Menetus		1
Physella		1
MEGALOPTERA		
Sialis	-99	
ODONATA		
Argia		1
Basiaeschna janata		1
Enallagma		5
TUBIFICIDA		
Branchiura sowerbyi	2	
Tubificidae	10	

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503073], Station #4.1, Sample Date: 9/13/2005 11:40:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
"HYDRACARINA"		
Acarina	1	2
AMPHIPODA		
Hyalella azteca		60
COLEOPTERA		
Berosus		1
Dubiraphia	2	95
Helichus basalis		1
Macronychus glabratus		3
Scirtidae		1
DECAPODA		
Orconectes luteus	-99	1
Orconectes virilis	4	1
DIPTERA		
Ablabesmyia	2	
Anopheles		3
Chironomus	14	1
Cladopelma	1	
Cladotanytarsus	2	
Cryptochironomus	1	
Dicrotendipes	3	3
Dixella	1	
Glyptotendipes	7	7
Hexatoma	1	
Labrundinia		1
Microtendipes	2	2
Parachironomus		3
Parakiefferiella		1
Paratanytarsus		51
Paratendipes	2	1
Polypedilum halterale grp	3	
Procladius	4	
Stictochironomus	3	
Tanytarsus	31	7
EPHEMEROPTERA		
Caenis latipennis	112	
Hexagenia	1	
Procloeon		1
Stenonema femoratum	7	
HEMIPTERA		

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0503073], Station #4.1, Sample Date: 9/13/2005 11:40:00 AM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
Rheumatobates		1
ISOPODA		
Caecidotea		1
LIMNOPHILA		
Ancylidae	33	8
Lymnaeidae		4
Menetus		2
Physella		5
ODONATA		
Argia		7
Enallagma		1
Libellulidae	1	
TRICHOPTERA		
Hydroptila		1
Oecetis	1	
Pycnopsyche		-99
TUBIFICIDA		
Branchiura sowerbyi	5	
Limnodrilus hoffmeisteri	3	
Tubificidae	47	1
VENEROIDEA		
Sphaeriidae		1

Aquid Invertebrate Database Bench Sheet Report
Little Dardenne Ck [0503074], Station #1, Sample Date: 9/13/2005 12:15:00 PM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
"HYDRACARINA"		
Acarina		11
AMPHIPODA		
Hyalella azteca		5
COLEOPTERA		
Berosus		1
Coleoptera	1	
Dubiraphia	1	
Scirtidae	1	64
DECAPODA		
Orconectes virilis	-99	2
DIPTERA		
Anopheles		5
Ceratopogoninae	51	
Chaoborus	3	
Chironomus	83	11
Cladopelma	4	
Cryptochironomus	2	
Culex		1
Dicrotendipes	3	32
Einfeldia	35	1
Glyptotendipes	3	26
Kiefferulus	5	38
Labrundinia		3
Parachironomus	2	23
Polypedilum halterale grp	1	1
Polypedilum illinoense grp		1
Procladius	2	3
Tanypus	16	
Tanytarsus	17	20
EPHEMEROPTERA		
Caenis latipennis	11	15
Callibaetis		2
Hexagenia	2	
Procloeon	1	
HEMIPTERA		
Microvelia		2
Ranatra nigra		1
Steinovelia		1
LIMNOPHILA		

Aquid Invertebrate Database Bench Sheet Report
Little Dardenne Ck [0503074], Station #1, Sample Date: 9/13/2005 12:15:00 PM
NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	NF	RM
Ancylidae		1
Lymnaeidae		1
Menetus		26
Physella		10
ODONATA		
Libellula		1
Somatochlora	1	2
Tetragoneuria		-99
TUBIFICIDA		
Limnodrilus hoffmeisteri	3	
Tubificidae	37	8
VENEROIDEA		
Sphaeriidae		1

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602635], Station #3, Sample Date: 3/13/2006 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	7	2	12
AMPHIPODA			
Crangonyx	-99		
Hyalella azteca	1	1	6
COLEOPTERA			
Berosus	5	5	
Hydroporus		2	2
Peltodytes			1
Scirtidae			1
Stenelmis	3	2	
DIPTERA			
Ablabesmyia	3	7	5
Ceratopogoninae	22	9	3
Chironomus		5	
Cladopelma		3	
Cladotanytarsus	5	1	
Clinocera	8		
Clinotanypus		3	
Corynoneura	1	2	2
Cricotopus/Orthocladius	97	13	10
Cryptochironomus	2	5	
Cryptotendipes		4	
Dicrotendipes	12	10	7
Diptera			1
Eukiefferiella	8	1	
Glyptotendipes		1	7
Gonomyia		1	
Hexatoma		-99	
Hydrobaenus	178	55	21
Ormosia		7	
Orthocladius (Euorthocladius)	21		
Parachironomus			1
Parakiefferiella			2
Paramerina			2
Parametriocnemus	1		
Paratanytarsus	6	5	97
Paratendipes		1	
Phaenopsectra	1		
Polypedilum convictum grp	12		4

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602635], Station #3, Sample Date: 3/13/2006 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	2		
Polypedilum scalaenum grp	1	3	2
Procladius		12	1
Pseudochironomus		1	
Rheotanytarsus	1		2
Simulium	1		
Stempellinella		2	
Tabanus	1		
Tanytarsus	48	64	18
Thienemanniella	5	1	
Thienemannimyia grp.	3		
Tipula	-99		
Tribelos		1	4
Tvetenia	3	1	
EPHEMEROPTERA			
Caenis latipennis	147	47	4
Stenacron	1		1
Stenonema femoratum	7	1	
Tricorythodes	2		
HEMIPTERA			
Belostoma			-99
Microvelia			1
ISOPODA			
Caecidotea		1	
Lirceus	1		
LIMNOPHILA			
Ancylidae			1
Fossaria		1	2
Menetus		1	10
Physella	2	1	3
Planorbidae			1
ODONATA			
Calopteryx			1
Libellula		1	
PLECOPTERA			
Amphinemura	1		
Capniidae	1		
Chloroperlidae	1		
Hydroperla crosbyi	-99		
Isoperla	4	1	
Perlesta	5		

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602635], Station #3, Sample Date: 3/13/2006 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Strophopteryx	1		
TRICHOPTERA			
Cheumatopsyche	6		
Hydroptila	3	1	1
Neureclipsis		1	
Oecetis	1		
Rhyacophila	1		
TRICLADIDA			
Planariidae	6	1	1
TUBIFICIDA			
Branchiura sowerbyi	1	3	
Limnodrilus hoffmeisteri		3	
Tubificidae	2	5	1

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602636], Station #4, Sample Date: 3/13/2006 2:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
N/A			
Gordiidae	2		
"HYDRACARINA"			
Acarina	1		1
AMPHIPODA			
Hyalella azteca			18
COLEOPTERA			
Dubiraphia			10
Helichus lithophilus	1		
Peltodytes			1
Stenelmis	8		
DECAPODA			
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		1	
Ceratopogonidae	2	2	2
Chironomus	7	8	
Chrysops		1	
Cladotanytarsus	13	12	
Clinocera	15		
Corynoneura	17	2	22
Cricotopus/Orthocladius	19	3	13
Cryptochironomus	2		
Cryptotendipes		1	
Dicrotendipes	1	2	7
Eukiefferiella	22		
Glyptotendipes	2		5
Hexatoma	8		
Hydrobaenus	308	55	28
Nanocladius			1
Ormosia		3	
Orthocladius (Euorthocladius)	16		
Parametriocnemus	2		
Paratanytarsus	6	9	123
Paratendipes	4	10	
Phaenopsectra		11	5
Polypedilum convictum grp	1		
Polypedilum halterale grp		1	
Polypedilum scalaenum grp	4		1
Rheotanytarsus	2		

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602636], Station #4, Sample Date: 3/13/2006 2:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Simulium	1		
Stempellinella	1		
Stictochironomus	6	13	
Tanytarsus	43	73	21
Thienemanniella	8	1	4
EPHEMEROPTERA			
Acentrella	1		
Acerpenna	1		
Caenis latipennis	64	25	14
Procloeon			6
Stenonema femoratum	2		
HEMIPTERA			
Microvelia			1
ISOPODA			
Caecidotea	2		
LIMNOPHILA			
Ancylidae	1		2
Fossaria	2		
Menetus	1		2
Physella	3	2	3
ODONATA			
Gomphus		1	
Ischnura			1
PLECOPTERA			
Allocapnia	1		
Chloroperlidae	2		
Isoperla	12		
Perlesta	9	1	
TRICHOPTERA			
Cheumatopsyche	2		
Rhyacophila	1		
Triaenodes			1
TUBIFICIDA			
Branchiura sowerbyi		-99	
Limnodrilus hoffmeisteri	7	2	
Tubificidae	5	14	1
VENEROIDEA			
Sphaeriidae		1	

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602637], Station #4.1, Sample Date: 3/13/2006 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1		1
AMPHIPODA			
Bactrurus		1	
Hyalella azteca			7
COLEOPTERA			
Dubiraphia			3
Enochrus			1
Helichus lithophilus			7
Hydroporus		4	
Peltodytes			3
Scirtidae			2
Stenelmis	1	2	1
DECAPODA			
Orconectes virilis			-99
DIPTERA			
Ablabesmyia			1
Ceratopogoninae	1	3	1
Chironomus		5	
Cladotanytarsus	4	8	
Clinocera	20	3	3
Corynoneura	17	3	23
Cricotopus/Orthocladius	9	1	8
Cryptochironomus		3	
Dicrotendipes	2	1	2
Diptera	2	1	
Dixella			6
Eukiefferiella	8		1
Glyptotendipes			4
Hydrobaenus	271	38	11
Microtendipes		2	
Nanocladius	1		2
Orthocladius (Euorthocladius)	11	1	
Parametriocnemus	4		
Paratanytarsus	4	6	148
Paratendipes		17	
Phaenopsectra		1	12
Polypedilum convictum grp	1		
Polypedilum halterale grp		1	
Polypedilum illinoense grp	2		2

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602637], Station #4.1, Sample Date: 3/13/2006 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procladius		1	
Prosimulium	1		
Rheotanytarsus	1		
Simulium	3		
Stempellinella		1	
Stictochironomus		33	
Tabanus	-99		
Tanytarsus	27	54	16
Thienemanniella	6		3
Thienemannimyia grp.		1	
Tipula	-99		
Tvetenia	12		
EPHEMEROPTERA			
Acerpenna	1		
Ameletus lineatus	1		
Caenis latipennis	19	62	13
Hexagenia limbata		1	1
Procloeon			19
Stenonema femoratum	2	5	
ISOPODA			
Caecidotea	8		
LIMNOPHILA			
Ancylidae		1	1
Menetus		1	
Physella	1	1	2
ODONATA			
Enallagma			1
PLECOPTERA			
Chloroperlidae	2		
Isoperla	43		1
Perlesta	11		
Prostoia	1		
TRICHOPTERA			
Cheumatopsyche	-99		
Pycnopsyche			2
Rhyacophila	11		
TUBIFICIDA			
Aulodrilus		2	
Branchiura sowerbyi		2	
Enchytraeidae		4	2
Ilyodrilus templetoni		1	

Aquid Invertebrate Database Bench Sheet Report
Dardenne Ck [0602637], Station #4.1, Sample Date: 3/13/2006 2:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Limnodrilus hoffmeisteri		1	1
Tubificidae		3	

Aquid Invertebrate Database Bench Sheet Report
Little Dardenne Ck [0602638], Station #1, Sample Date: 3/13/2006 3:20:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2		7
AMPHIPODA			
Hyalella azteca			9
COLEOPTERA			
Dubiraphia			2
Helichus basalis			2
Peltodytes			3
Scirtidae	3		25
Stenelmis	6		1
DIPTERA			
Ablabesmyia			1
Ceratopogoninae	7	1	4
Chironomus		2	
Cladotanytarsus	6	1	
Clinocera	15		
Corynoneura		2	1
Cricotopus/Orthocladius	31	1	10
Dicrotendipes	1	4	17
Endochironomus			1
Eukiefferiella	14		
Glyptotendipes		2	58
Hemerodromia	4		
Hexatoma	1		
Hydrobaenus	409	267	21
Kiefferulus		2	1
Nanocladius			1
Parametriocnemus	2		
Paraphaenocladius			2
Paratanytarsus		1	18
Polypedilum halterale grp	1	2	
Polypedilum illinoense grp			4
Polypedilum scalaenum grp	3		
Procladius	1	2	
Stictochironomus	1	1	
Tabanus	1		
Tanytarsus	15	11	11
Tipula	1		
Tipulidae	7	1	
Tvetenia	28		

Aquid Invertebrate Database Bench Sheet Report
Little Dardenne Ck [0602638], Station #1, Sample Date: 3/13/2006 3:20:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
EPHEMEROPTERA			
Caenis latipennis			8
Callibaetis			2
HEMIPTERA			
Belostoma			1
ISOPODA			
Caecidotea	14		
LIMNOPHILA			
Menetus			2
Physella			10
ODONATA			
Libellulidae			1
PLECOPTERA			
Allocapnia	6		
Amphinemura	5		
Chloroperlidae	5		
Hydroperla crosbyi	1		
Isoperla	45		
Perlesta	37		
Prostoia	1		
TRICHOPTERA			
Phryganeidae	1		
Pycnopsyche			1
Triaenodes			1
TUBIFICIDA			
Enchytraeidae	33	3	1
Limnodrilus claparedianus		1	
Tubificidae	3	3	1